Smart House Lighting

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HEROTECH

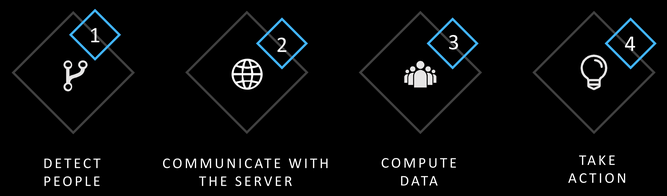
INTRODUCTION & GOAL

Our world is continuously changing and the natural resources are limited. Unfortunately, in some countries the resources used for creating electricity are non-renewable, so we must act now to change the future of our planet. By making this project, we hope we could contribute with a solution that not only facilitates our lives, but will also help reduce the consumption of electricity.

The main aim of our application is to reduce energy consumption in a house by automatically switching on and off the lights. Another goal is to make our houses more comfortable. By doing this, we will be able to decrease pollution and usage of non-renewable resources. Needless to say that all of these could contribute to a better life on Terra.

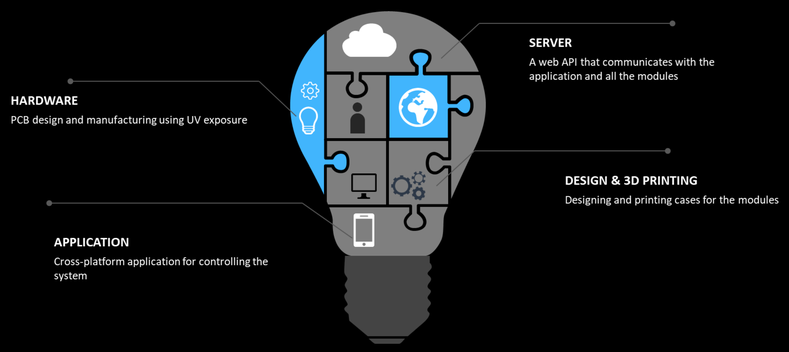
PROJECT OVERVIEW

Smart House Lighting is a system that counts the number of people in every room of a house, using the infrared barrier method. This is composed of 3 modules: an emitter, a receiver and a controller module. An emitter and a receiver represent a pair, which is placed on the doorframe, so that our device is able to detect when the IR ray is interrupted. Every door requires two of these pairs to detect the way the person came from. Based on the number of people counted in every room, the luminaries are controlled automatically.

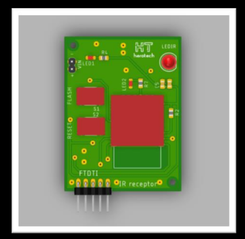


When a person walks from a room to another the following things happen:

1. Both of the receivers modules will stop getting the IR signal from the emitter.
2. Each send a request to the server letting it know they have been triggered.
3. The server compares the times the requests arrived and deducts the room from which the person came. After that it updates the number of people from the two rooms.
4. If needed, the server sends a request to controller modules for switching on/off the lights.

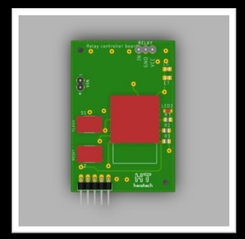


HARDWARE



EMITTER MODULE

RECEIVER MODULE

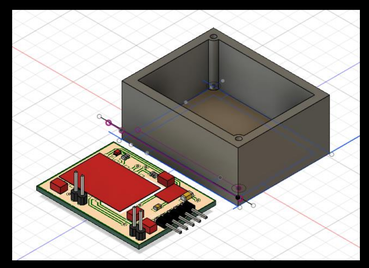


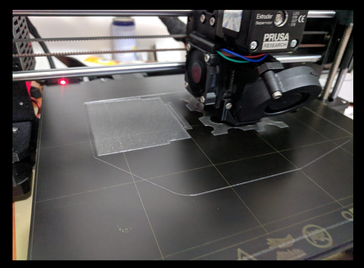
CONTROLLER MODULE

- **The emitter** is a simple electronic circuit with an IR led and a resistor. This part is connected at a 9V battery and emit IR light continuously.
- **The receiver** is designed around the ESP8266 chip, that send information based on data read on ADC pin. The IR led receptor acts like a resistor whose value is changing depending on the received light. Based on it, we made a voltage divider with this led and a resistor.
- **The controller** switches on or off the lights, based on some information received from server.

The power supply for the last two modules is a 9V battery, so we used a linear 3V3 voltage regulator. Both of these boards are programmed via a FTDI programmer, using some specific pins (3V3, GND, RX, TX).

DESIGN & 3D PRINTING



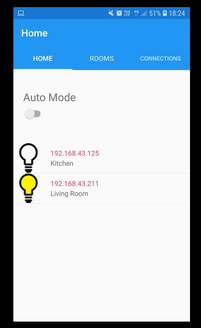


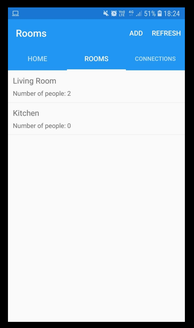
Using Autodesk Fusion360 software, we designed some cases for our sensors. We exported our PCB layouts from EAGLE to Fusion360 and we integrated them in simple boxes which we printed, using 3D technology.

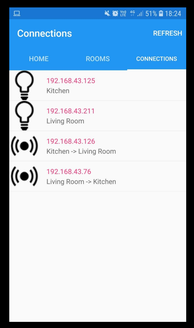
SERVER

The server is a web API developed in the .NET environment using the ASP.NET CORE framework, therefore the communication protocol between the modules and the server is HTTP. The API exposes some controllers such as: *Connections*, *Esp* and *Rooms*. The Esp controller is accessed by the modules. For example, the first time a module is powered on, after it connects to the Wi-Fi, it makes a get request on the *RegisterESP* action. To distinguish the modules the server generates a globally unique identifier that is saved in the database and also sent back to the module. The Connections Controller is accessed by the application to receive the list of all modules connected to the server and to configure them. All the bodies of the requests and responses of this controller are encoded in JSON.

APPLICATION







The application is developed in the .NET environment using the Xamarin.Forms framework, therefore it’s cross-platform.

- **The home page** has a switch for setting the mode of our system: automated or manual. When the manual mode is selected, the application displays a list of every controller module that is connected to the server, and it lets the user to manually select which lights should be on
- **The rooms page** displays a list of the rooms from the database, each showing the current number of people. We can also create a new room by clicking a button from the toolbar
- **The connections page** consists of a list of all the modules connected to the server. A light bulb icon is used for controllers and a sensor icon for the receivers. By tapping an item on the list we can configure the location of that module. If we don’t know its location, we can press a button that will make a led on our module blink for a couple of seconds.

CONCLUSION

In conclusion, we hope our project is useful and that it will have a positive effect on our lives. By making this system, we want to digitalize our houses and make them more comfortable. Besides, a very important aim is having a positive impact on the environment, by diminishing energy consumption. In the future, our team will improve this system, by making it easier to use, with a more attractive interface. We already have a lot in mind, like changing the communication protocol to one that is better suited for IoT devices resulting in reduced electricity consumption.

REFERENCES

- http://www.esp8266learning.com/
- https://docs.microsoft.com/en-us/aspnet/core/?view=aspnetcore-2.1
- http://www.university.xamarin.com/